The Art of Good Writing

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1. Why worry about your writing

Students of engineering or science may feel when they are required to submit written assignments that "*it's ok as long as they can understand what I mean*".

Nothing could be further from the truth.

In their professional work, engineers and computer scientists frequently have to prepare written documents. If they are not good at it then they do not like doing it. The problem is that if they cannot write well it adversely affects their work.

A badly written report will fail to convince its reader and may be rejected or ignored. A poorly expressed application for funds or project proposal may well fail to be accepted. All professionals need to be able to write well if they are going to be effective in their job.

The American Society for Engineering Education (ASEE) investigated which academic subjects are considered the most important to the engineering discipline[1]. The investigation surveyed 4,057 graduate engineers who had several years of engineering employment. Of the 38 academic subjects investigated the survey revealed that communication skills are widely seen as the most important. The following table shows how five communication skills were ranked in terms of importance by the respondents:

Skill	Rank
Technical writing	2
Public speaking	4
Working with individuals	6
Working with groups	7
Talking with people	9

This article suggests some helpful guidelines for good technical writing as practised by engineering and computing professionals. You should follow these guidelines in all of your technical writing throughout your university studies, and more importantly when you begin work as a professional engineer or computer scientist.

2. What is different about 'technical' writing?

Technical writing, as distinct from informal writing and writing found in novels, newspapers and magazines, should display four key characteristics: brevity, precision, clarity and objectivity.

- **Brevity**: Professionals are often pressed for time, so superfluous material should be omitted. Only details essential for the purpose of the document should be included.
- **Precision**: By choosing just the right word the writer can avoid ambiguities and confusion. Wherever possible, facts should be quantified.
- **Clarity**: Explanations should be simple but complete. Arguments should be logical. Good structure often helps to ensure clarity.

Objectivity: Statements should be supported by facts. Exaggeration of the facts and invocations of emotion should be avoided. Objectivity can be achieved by use of the *passive voice*, avoiding use of the *first person* (I, we, my, our).

In the following sections you will find guidelines that will help you achieve these four characteristics in your technical writing.

[1] Middendorf, W.H. (1980). Academic programs and industrial needs. *Engineering Education, 71* (8), 835-837

3. Making your writing 'compelling'

In all forms of professional writing the main objective is to have your reader read and understand the message that you are trying to communicate. Often you are trying to convince the reader of something: to go ahead with your proposal, or grant you more funds, or accept the findings of your report. Because of its purpose we call such writing 'persuasive' or 'compelling' writing.

The following sections suggest how you can make your writing more compelling and effective.

3.1 Consider your audience, purpose and desired outcome

Audience*:* Think about who is going to read your document. Consider what information they already have, and what facts they know, then pitch your writing appropriately. Do not dumb it down, but avoid going over your audience's head. On the other hand avoid boring them with material they already know. If your audience covers a wide range consider using appendices to include additional explanatory material.

> It maybe sometimes helpful to adjust the 'register'[2] that you use, to match your audience, though it is not generally a good idea to be too colloquial. If in doubt keep it formal.

Purpose: Be clear about why are you writing your document. Make the purpose of the document clear to the reader in your opening paragraphs. That will also help to keep you on track. Provide all the information necessary to support your argument.

Desired Outcome: In the final paragraphs make state clearly what the outcome you are expecting and what action you expect to be taken.

3.2 Have a good 'logical' structure

Your writing should follow a logical 'argument'. Begin by setting out what you want to achieve, develop all the facts and arguments necessary to support your view and then round off by enunciating the 'obvious' conclusion.

Though not strictly necessary, it is often helpful to emphasise the structure by including headings, as has been done in this document. If your reader simply skims the headings they should be able to get a fair idea of the 'shape' of the argument. This can be further helped by using more than one level of heading, such as 3., 3.1, 3.2 and so on. You should also consider using the *Outline* view provided by *Microsoft Word* as a tool to help you develop a good structure.

The ideas in the next two sections will help you to improve the structure of your writing.

3.3 Take care with your paragraph structure

Paragraphs are the basic building block of your writing. Each paragraph serves a specific function in developing your argument. Good paragraph structure is perhaps the most important requirement for good writing.

The first sentence in a paragraph is called the '**topic sentence**'. It announces to the reader what the paragraph is all about. All the sentences in the paragraph should then relate to the same idea. If there is suddenly a different idea introduced it should be in a new paragraph.

Students often try to fit too many ideas into one sentence, which simply makes it difficult to understand. The same applies to paragraphs. Consider the following:

> *Given its prominence it is perhaps not surprising to find that the topic of IS failure has been a fervent area of debate for academics in the information systems, software engineering and computer science areas for a number of years, and, considering the amount of published theoretical work, which has helped academics and practitioners to achieve a better understanding of the multi-faceted nature of IS failure, it is perhaps surprisingly, none the less, to find that what empirical data we have on this topic is limited to either anecdotal evidence, or case studies of different orders and indeed quality, and a limited amount of survey work, so that this evidence has served no more than to*

[2] The 'register' of language usage is a situation-specific variation, for example language of a type that is used in particular social situations or when communicating with a particular set of people.

> *validate, and that in a very broad manner, some of the theoretical approaches that aim to explain the phenomenon of IS failure.*

How many ideas are included here? What is the paragraph (actually a single sentence) about? What we need to do is to determine a topic sentence that encapsulates the content of the whole paragraph, and then break it up into a series of sentences that all relate to the same topic. Do you think the following paragraph is clearer? Does it express the same ideas? Is it easier to read and understand?

> *The topic of IS failure has been a fervent area of debate for academics in the information systems, software engineering and computer science areas for a number of years. Over these years there has been a large amount of published theoretical work, which has helped academics and practitioners to achieve a better understanding of the multi-faceted nature of IS failure. Given the prominence of IS failure, what is perhaps surprising, however, is that what empirical data we have on this topic is limited to either anecdotal evidence, case studies of different orders and indeed quality, and a limited amount of survey work. None the less this evidence has helped in validating, in a very broad manner, some of the theoretical approaches that aim to explain the phenomenon of IS failure.*

3.4 Linking paragraphs

A good way to keep the structure of your document is to make sure that paragraphs are 'linked'. This can be done by introducing an idea in the last sentence of one paragraph and enlarging on the idea in the following paragraph. You can see that this has been done in section 3 and 3.1 above.

> "The most effective way to achieve compelling writing is to ensure a **good logical structur**e.
>
> ***3.1 Logical structure***
>
> *Your writing should read like a* ***logical*** *'argument'."*

The bolded words show how the paragraphs are linked by means of the common idea "logical structure". In this way you provided your reader with a 'road map' through your document. At the end of each paragraph the reader should nearly be able to guess what the next paragraph is going to be about. If when you read over your work you feel that some new idea has come unexpectedly from 'left field' so that the reader could not have anticipated it, then you probably need to check your structure.

Good writers can sometimes break this rule intentionally for a special effect – to surprise their reader – but it must be done sparingly and with care.

3.5 Keep your writing interesting

The most important paragraph in a document is the first one. If it does not capture the reader's attention then the reader may skip the rest.

Once you have captured your reader's interest, then you need to keep it. Here are some ways that will help:

1. Make your topic sentences varied, so that they do not become monotonous, for example on page 74 of this *Course Handbook* you will see the following beginnings of topic sentences:

   Donald E Knuth designed a new typesetting program…
   LaTeX is a powerful typesetting system…
   LaTeX is open source and very stable …
   Although many people prefer WYSIWYG word processors …
   Some publishers such as the ACM, Elsevier, IEEE and Kluwer …
   The basic philosophy of LaTeX …
   When a text document is compiled, LaTeX …

   Imagine what it would it be like if every paragraph began "*LaTeX is …*"?

2. Choose the 'right' word for your purpose, the exact word that conveys your meaning clearly and precisely. For example the writer could have written "*this topic is limited to what people have said*" instead he wrote "*this topic is limited to anecdotal evidence*" (Section 3.3 above). The word *anecdotal* has a very special meaning and conveys the precise idea intended.

3. Phrase your ideas in new and interesting ways, for example in the passage above the author could have written "*academics have argued a lot about the topic of IS failure*" but instead chose to write

"*The topic of IS failure has been a fervent area of debate for academics*". Perhaps a bit flowery, but certainly more interesting.

4. Ways to improve your writing

There are many tricks that authors can use to make their writing more effective. In the following sections are some ideas that will help you to produce good professional writing.

4.1 4.1 Select an appropriate level of detail

Include only as much detail as is necessary. The reader should be able to easily follow your methodology, results, and logic without being distracted by irrelevant facts and descriptions. When you are checking your document ask yourself: F*rom the data provided, will the reader be able to follow the flow of logic I used to reach my conclusions?* If the answer is 'yes' then the level of details is sufficient.

It is often a good idea to make your point first with little detail, and then to expand on the idea in subsequent paragraphs. That way the reader will get the overall idea and have the correct mind set to appreciate the detail provided afterwards.

A similar idea is illustrated in Section 2 above which states that "*professional writing should display four key characteristics, brevity, precision, clarity and objectivity*" in one paragraph and then proceeds

to expand on each point individually in the following paragraphs. Make sure that if you do this sort of thing that you treat the points in the same order that you list them.

4.2 Use consistent word structures

When writing lists of items or activities it is important to be consistent, for example using the same grammatical forms and parts of speech. This helps the reader anticipate what you are going to say and provides a framework for understanding. As a bad example consider the sentence[3]:

> *"Technical writing ranges from editing of online help files, document engineering, user's manual for software and hardware, to writing of product sheets and other product pertaining instructions."*

This sentence contains four items, presumably all of equal importance, yet two are presented as participles, one as a gerund, and one as noun. The reader has to struggle to figure out what the writer is saying and what could be coming next. It could be expressed more consistently as:

> *"Technical writing involves editing and writing many kinds of documents including online help files, user's manuals, product information sheets, and product instructions."*

Also take care to be consistent when listing a series of examples from a common stem. For example suppose the objectives of a unit of study are stated as:

> *"By the end of this unit of study successful students will be able to:*
>
> 1. *Demonstrate word processing skills.*
> 2. *Show evidence of understanding professional issues.*
> 3. *Retrieve information about a particular topic using Google.*
> 1. *Display the ability to make an oral presentation."*

It can be seen that each example begins with a verb, consistent with the stem "*will be able to*". The following shows what can happen if the form of the examples and the stem are not consistent:

> *"By the end of this unit of study successful students will be able to:*
>
> 1. *Demonstrate word processing skills.*
> 4. *Understanding professional issues.*
> 5. *Retrieval of information about a particular topic using Google.*
> 2. *A good oral presentation."*

[3] Michele Arduengo of the Promega Corporation, 2007

4.3 4.3 Avoid acronyms and abbreviations

The Oxford Companion to the English Language defines three types of acronyms:

- letter acronyms: (like NASA, GIF, QUANGO) made up from initials
- syllable acronyms: (like internet, sysadmin, syscom) made up from parts of words
- and hybrids of these: (like WaSP, SIGGRAPH, e-Commerce) made up of both.

There are many acronyms of one or other type that are now part of the language and to whose use there can be no objection, such as radar, IBM, USB, HTML, OPEC and so on.

However, many students and professionals too, seem to think that coining new acronyms is either helpful or clever. The fact is it is neither. By way of example, the following paragraph is taken from a student thesis. It illustrates how badly the overuse of acronyms can affect understanding:

> *"Most existing scheduling policies that are used to distribute work-units (WUs) in VC (Volunteer Computing) environments are based on simple heuristics. Up to now there are two different policies: the First-Come-First-Serve (FCFS) policy commonly used in BOINC projects and the fixed threshold-based policy. Both policies use Homogeneous Redundancy (HR) for the distribution of multiple work-unit instances (WUIs). HR distributes instances of the same WU to volunteer computers that are computationally equivalent, meaning that that they have the same operating system and processor vendor (e.g. Intel or AMD). This yields bit-identical successful results for chaotic applications".*

One objection is that in many cases the acronym is defined, but then never ever used again. Another is that if the reader dives into the document some way through, then acronyms are totally incomprehensible, for example the acronym BOINC was no doubt defined somewhere, but not here. A third objection is that often there is a precedent for the proposed acronym that is in wide use, for example HR (above) is normally used for "human resources".

As far as the reader is concerned the use of acronyms serves no useful purpose, it is just an irritation. While reading he/she is expected to make the necessary substitutions. The result is that the writing becomes unbelievably tedious. Consider the following passage from a text book:

> *"The scope statement is the primary input for creating a WBS. The main technique is to subdivide each deliverable into smaller pieces using a WBS template. The WBS creation process may result in the production of several WBSs, plus the WBSs' dictionaries, together with a scope baseline and a scope management plan."*

Imagine how tedious this becomes if you simply substitute "*Work Breakdown Structure*" every time you see *WBS*. It becomes even worse when you see *WBSs* or *WBSs'*, that is, of course, assuming that you knew what WBS stood for. It is better for the writer to do the work and write instead:

> *"The scope statement is the primary input for creating a **work breakdown structure**. The main technique is to subdivide each deliverable into smaller pieces using a **breakdown structure** template. The process of creating such a **work breakdown** may result in the production of several **structures**, plus the dictionaries for each **breakdown**, together with a scope baseline and a scope management plan."*

There seems also to be an universal desire among students to find clever and meaningful acronyms for their team projects. Is this useful? James Bradley Summers[4] suggests some acronyms that he says could be used in connection with trauma examinations in accident and emergency: **FAST** (Focused Assessment with Sonography for Trauma) or **SLOH** (Systemic Look for Occult Haemorrhage).

4.4 Quantify facts where possible

It is more precise to use quantitative rather than qualitative descriptions. A phrase that uses definite quantities such as "development rate in the 30 C temperature treatment was ten percent faster than development rate in the 20 C temperature treatment" is much more precise than the more qualitative phrase "development rate was fastest in the higher temperature treatment".

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[4] "Acronym Addiction" Texas Heart Institute Journal, Volume 31, Number 1, 2004, 108-9

Emotive but imprecise words like "*huge*", "*massive*", "*world-wide*" and "*disastrous*" usually result in exaggeration. It is better to replace them with more precise words, quantified where possible. So rather than reporting "*a massive car pile-up with disastrous results*" would be more precise, though less sensational, to write "*an accident on the freeway involving fifteen cars and five trucks*".

Where there is a significant amount of numerical consider using a table. For example rather than writing "*The average monthly temperatures for the six month period were June, 18, July, 17, August, 21, September, 24, October, 27 and November, 31*." consider setting out the information for example as:

"***Table 1** shows the average monthly temperatures for the six month period.*"

Month	**Average Temperature (deg C)**
June	18
July	17
August	21
September	24
October	27
November	31

4.5 Take care when using the passive voice

There was a time when all scientific and technical writing employed the third person, passive voice. This position seems to have softened somewhat. Indeed Microsoft Word's Grammar check throws up the use of the passive as some kind of error!

The rationale behind using the passive voice in scientific writing was that it enhanced objectivity, taking the actor (the researcher) out of the action (the research). Unfortunately, in some cases the passive voice can also lead to awkward and confusing sentence structures, because of its detachment it may sound less engaging than the active voice. Many style guides today recommend sparing use of the passive voice, however, it is still widely used in professional writing.

Use of the active voice necessitates the use of "I" or "we", for example: "We performed a two-tailed t-test", whereas using the passive this would be "a two-tailed t-test was performed". If you choose to use the active voice with "I" or "we," there are a few things to be careful of:

- Avoid using "I" or "we" when you are making a conjecture or drawing a conclusion. Conclusions should follow from logic, not from personal opinion.
- Avoid emotive words in conjunction with "I" or "we" such as "I believe," "we feel".
- Avoid the use of "we" in a way that includes the reader, for example "here we see how the breakdown is achieved". This seems to imply a rather conspiratorial tone.

4.6 Use jargon carefully

You often hear people decrying the use of 'jargon' in documents, that is words that have a special meaning in specific circumstances. For example 'hard drive' and 'mother board' and 'usb port' all have quite precise meanings in computing, and therefore they should be used for communication in technical and professional writing. If a wider readership is expected it might be a good idea to include a "Glossary of terms" so that all readers can understand.

4.7 Avoid using 'big' words for their own sake

Students sometime feel that by using 'big' words, or words that are uncommon, they sound knowledgeable. Within reason, it is best to use simple words that everybody understands, but also remember the point made above that you should seek the very best word for the job in every case.

4.8 Avoid being verbose or pompous

Professionals on the whole are busy people. They appreciate concise writing. Unnecessary words or phrases tend to distract the reader. Avoid clichés and phrases convey no useful information, such as "at the present point in time," "it should be noted that," and "it is a fact that".

If your writing is pompous or high handed your reader might well develop antagonistic feelings toward your document and to the message you are trying to convey.

5. Checking your work

The last step in writing a document is proofreading. These days there is little excuse for spelling errors though there are plenty of funny stories of spelling checkers creating havoc. One such is the example reported by Michele Arduengo of Promega Corporation, who received the following email from the maintenance section:

> *"The steam will be shut off on Friday afternoon April 1st. Sorry for incontinence this may cause. We will be in full operation by Tuesday."*

The desired word, 'inconvenience', had been misspelled by the typist. The spell-check program automatically corrected it to incontinence. Spelling checkers are not much help either when it comes to deciding between 'there' and 'their, 'through' and 'though', 'hair' and 'heir' or 'of' and 'off', and so on.

As well as spelling it is important to check punctuation and grammar. Incorrectly placed commas and pronouns too far from their antecedents can cause much misunderstanding and confusion.

Apostrophes are always tricky. One error commonly found is the confusion between *its*, which is a possessive as in "the dog and its fleas", and *it's* which is a contraction of "it is", as in "*It's a long, long way to Tipperary*". Make sure that you get it right.

Any small slip such as those discussed above will take the polish off your professional writing, distracting your reader so that they become more interested in looking for the next error than comprehending your message.

If you want to get your message across, it is no good writing a *nearly* perfect document. Always check your work!

6. Some useful references

Alley, Michael (1996). *The craft of scientific writing*, 3rd edition. New York: Springer-Verlag. Barrass, Robert (2002). *Scientists must write*, 2nd edition. New York: Routledge. Day, R. A. (1995). *Scientific English*: a guide for scientists and other professionals. (2nd ed.) Phoenix,

AZ: Oryx Press. Strunk, W. and White, E.B. (1979) *The Elements of Style*, 3rd. edition, Boston, MA, Allyn and Bacon.

"Writing, citing and referencing" Sydney University Library website: http://sydney.edu.au/library/skills/